DOCUMENT RESUME

ED 436 862 EC 307 535

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TITLE New Treatments for Autism: Effects of a Gluten-Free Diet on Rate of Learning.
PUB DATE 1999-00-00
NOTE 7p.
PUB TYPE Reports - Research (143)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Autism; Behavioral Science Research; Data Analysis; Data Collection; Intervention; *Learning Processes; *Nutrition; *Outcomes of Treatment; *Therapy
IDENTIFIERS *Gluten

ABSTRACT

This study assessed the effects of a gluten-free diet over one year on learning patterns in three autistic children (ages 5 to 8) participating in an applied behavioral analysis program. Rates of learning for five behavioral targets 3 months, 6 months, 9 months, and 12 months after the start of the diet were compared using a within-subjects analysis. The total number of attempts for the last five targets mastered comprised the post-treatment scores for each participant. Data indicated that time on the gluten-free diet was not significantly related to the number of learning trials needed for task mastery. High variability in scores and lack of control for task difficulty level appeared to be responsible for these mixed results. (Contains 18 references.) (DB)

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New Treatments for Autism:

Effects of a Gluten-Free Diet On Rate of Learning

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1999

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In recent years, some theorists have speculated that the inapt metabolism of the proteins found in gluten is contributes to the development of autistic symptoms. This hypothesized link between the behavioral symptoms of autism and allergy to gluten has spurred many families with autistic children to eliminate gluten from the diets of their children. Since implementing gluten-free diets, many of the parents report noticing extreme behavioral improvements in their children, including reduced aggression and increased submissiveness. The current investigation examined the effects of the gluten-free diet on learning in autistic children in an applied behavioral analysis program, extending the work of Gemmell (1997), Gemmell and Chambliss (1997), and Pontino and Schaal (1998).

This study assessed the effects of the gluten-free diet at regular intervals during the first year after the children began the diet. Significant performance changes were observed when pretreatment baseline data was compared with the 1, 3, 6, 9, and 12-month posttreatment data, although no consistent pattern of improvement emerged during the course of the year when there comparisons were made. High variability in scores appeared to be responsible for the mixed results obtained. Further research is needed to establish the long-term efficacy of the gluten-free as a means of enhancing the learning rate of autistic children.

Introduction

Autism is a pervasive developmental disorder marked by severely impaired social, emotional, and intellectual functioning. Common characteristics include abnormal social relatedness, abnormality of communication development, repetitive patterns of behavior, and abnormal responses to stimuli (Edelson, 1997). Deviant responses to auditory, tactile, deep-pressure proprioceptive, vestibular, olfactory, and gustatory sensory events are not uncommon among diagnosed with autism (Powers, 1997). Autistic individuals also have difficulty in seeking

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comfort, imitating others, and participating in imaginative activities. These aspects of the disorder severely constrain the learning process, and contribute to why children with autism frequently display delays in achievement of developmental milestones.

The cause of autism is still debated, although increasingly etiological models emphasize neurophysiological factors. Among the many extant theories, some postulate genetic factors while others hypothesize the existence of structural abnormalities without genetic basis. A more recent theory about the cause of autism concentrates on a link between allergies and behaviors. Autistic children are presumed to have metabolic difficulties with gluten or wheat products, and casein or milk products. After researchers discovered the possible contribution that gluten made to autistic symptoms, many families removed gluten from their children's diet.

Knivsberg et al. (1995) has provided initial results on a study of a gluten-free diet as a treatment for autism. The diet was applied to 15 subjects with autistic syndromes. All the children participating had an increased level of peptides in their 24 hour urine samples and had pathological urine patterns. The child participants were given behavioral, psycholinguistic, and cognitive tests before they started the diet and one-year later.

After the first year of the diet, the children were communicating and responding more actively. They experienced a greater ease with emotional expression and with the formation of social relationships with other children. Appropriate play increased, while odd movements, fear, and avoidance of physical contact decreased. Also the urine samples were tested after one year and revealed normal urine patterns and peptide levels. Language was assessed via administration of the Illinois Test of Psycholinguistic Abilities (ITPA). All subscales, except for short-term memory, increased after the first year of the diet. A measurement of cognitive ability showed that the children used their cognitive abilities in a different way when they were on the diet. Parents and teachers observed a change in the children's motor abilities, due to a new awareness of their bodies. Bladder control increased, and their high pain threshold decreased.

Many outcome evaluations have been conducted to assess the impact of the gluten-free diet. These studies suggest that the gluten-free diet increases autistic individuals' psycholinguistic and cognitive skills. Given these findings, it seems reasonable to assume that this same diet would increase the behavioral achievement of the autistic individual exposed to structured learning experiences. Applied behavioral analysis was developed by Lovaas (1987) as a means of helping autistic children to master discrete learning objectives by using operant methods; it is currently viewed as one of the most effective approaches to treating this disorder (McEachin, Smith, & Lovaas; 1993). This treatment provides concrete criteria for measuring the efficiency of skill mastery. Behavior of children participating in this treatment is evaluated systematically, which allows for the

detection of subtle changes in learning rates. For these reasons, children receiving applied behavioral analysis have been used in several empirical studies assessing the impact of the gluten-free diet (Gemmell, 1997, Gemmell & Chambliss, 1997, and Pontino & Schaal, 1998). This study will assess the relationship between the number of trials needed to reach a behavioral criterion, and the number of months of dietary restriction, over a one year period.

Method

Participants were three autistic children, with ages ranging from five to eight years old (at the conclusion of data collection the average age of the participants was 7.7 years). They had an average of 3.1 years experience in an applied behavioral analysis program. All subjects had been on the gluten-free diet for at least one year.

Rates of learning for five behavioral targets 3-months, 6-months, 9-months, and 12-months after the start of the diet were compared using a within-subjects analysis. The total number of attempts for the last five targets mastered comprised the post-treatment scores for each participant.

Results

The within subjects analysis comparing the performance of participants between the baseline and 12th month diet showed a trend suggesting a negative dietary impact on patients' rate of learning. Significant differences in scores were found when the two groups were compared ($t=2.02$, $df=14$, $p<.06$). The mean number of trials to mastery at twelve months was 24.33 with a standard deviation of 35.42. The mean number of trials to mastery at the baseline was 5.93 with a standard deviation of 5.12.

A within subjects analysis compared the performance of participants between the baseline and 9-months on the diet. An insignificant difference in score was found when the two groups were compared ($t=.04$, $df=14$). The mean number of trials to mastery at 9-months was 5.87, with a standard deviation of 2.95.

The within subjects analysis compared the performance of participants between the baseline and 6-months on the diet. The 6-month scores show a trend suggesting a negative dietary impact on patients rate of learning. Differences were found when the two groups were compared ($t=1.80$, $df=14$, $p<.09$). The mean number of trials to mastery at 6-months was 15.87, with a standard deviation of 20.02.

The within subjects analysis compared the performance of participants between the baseline and 3-months on the diet. The 3-month scores were significantly worse than the baseline scores ($t=2.7$, $df=14$, $p<.01$). The mean number of trials to mastery at 3-months was 24.2, with a standard deviation of 25.81.

The within subjects analysis compared the performance of participants between the baseline and 1-month on the diet. The 1-month scores were not significantly better than the baseline scores ($t=1.88$, $df=14$, $p<.08$). The mean number of trials to

mastery at 1-month was 10.67, with a standard deviation of 7.19.

Discussion

The data indicate that time on the gluten-free diet is not consistently related to the number of learning trials needed for task mastery. This may reflect the diet's limited effectiveness, the diet's variable effectiveness across different children, or problems with outcome measures used in this investigation.

The gluten-free diet may not enhance children's rate of learning, even though it has been reported elsewhere to have a beneficial impact on various behaviors. On the other hand, the diet may improve the rate of learning in some cases, but not in others. This might lead to high variability within the data. Finally, the diet may enhance learning progress, increasing the difficulty of tasks attempted in the behavioral training. This might account for the nearly five-fold increase in the mean number of trials to task mastery from baseline to one year measurement. However, the fact that the trials to mastery at 9 months was nearly identical to that at baseline challenges this notion that presentation of more challenging tasks account for the observed increase in trials at the 1 year measurement.

Future investigations could use a weighting procedure to adjust the dependent measure for estimated task difficulty. This would create a more stable measure of rate of learning.

Effects of a Gluten-free Diet on Trial to Mastery

Trials:	mean	5.93	10.67	24.20	15.87	5.87	24.33
	s.d.	(5.12)	(7.19)	(25.81)	(20.02)	(2.95)	(35.42)
Time on Diet (in months)		Baseline	1	3	6	9	12

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